REMARKS

Claims 1-17 are pending in this application. By this Amendment, claim 1 is amended to be further distinguished from the cited art, and claims 9 and 10 are amended for rejoinder. Support for the amendment to claims 1, 9 and 10 can be found at least at, for example, paragraph [0013]. Claims 9-15 are currently withdrawn. Claims 16 and 17 are new. Support for the new claims can be found at least at, for example, paragraph [0041]. Thus, no new matter is added.

In view of the foregoing amendments and the following remarks, Applicants respectfully request reconsideration of the application.

I. Claim Rejections Under 35 U.S.C. §103

A. Kurihara In View Of Sugano

The Office Action rejected claims 1-4 and 6-8 under 35 U.S.C. §103(a) as allegedly having been obvious over Kurihara (JP 2000-223121) in view of Sugano (JP 2002-083595). Applicants respectfully traverse this rejection.

1. Introduction Of Sulfur

By this Amendment, claim 1 is amended to recite that the sulfur-containing compound provides elementary sulfur or a sulfur-containing functional group including sulfur to a surface of the electrode carbon material. See para. [0013].

Kurihara discloses a method of forming a carbon material for an electrode with a specific surface area of 0.1-900 m^2/g by thermal plasma-treating a raw material. See the Abstract and para. [0001] and [0031]. Kurihara discloses that the carbon material can be a resin system material that can be carbonized, mesophase carbon raw material or black lead system material. See para. [0026]. Kurihara does not describe or suggest introducing a sulfur compound to the carbon material. The Patent Office cited Sugano as allegedly remedying the deficiency of Kurihara.

Sugano discloses a method of forming a carbon material for a nonaqueous solvent negative electrode material. See the Abstract. Sugano describes that sulfur is added to a mix of mesophase pitch and coal tar pitch. See para. [0017]. However, Sugano discloses that the sulfur is added in the solid state (Sugano adds coffee mill ground sulfur to the mix of mesophase pitch and coal tar pitch). See para. [0017]. Sugano only discloses the addition of sulfur in the solid state and does not suggest the addition of sulfur in a different physical state. Thus, Sugano does not describe or suggest the use of sulfur in a plasma processing as in Kurihara. Therefore, the combination of Kurihara and Sugano would not have led one of ordinary skill in the art to have any reasonable expectation of success in introducing sulfur to the surface of a carbon material with a plasma processing.

Thus, one of ordinary skill in the art would not have been led to the claims of the present application because of the differing types of sulfur and differing physical state that sulfur is in when introduced to the carbon material.

2. Thermal Plasma Processing

Kurihara discloses a thermal plasma processing carried out on the carbon material in an argon and hydrogen or an argon and nitrogen mixed gas atmosphere. See para. [0035]. The thermal plasma processing causes the carbon material to graphitize. See para. [0031]. The resulting product is a carbon material with a large surface area and a large mean grain diameter. See the Abstract. Kurihara does not describe a method of thermal plasma processing that introduces sulfur to the carbon material.

Sugano describes a heat treatment process that graphitizes the carbon material in a nitrogen or an argon atmosphere at 2,000°C. However, the heat treatment is carried out with the ground sulfur already mixed in with the raw carbon material. See para. [0017]. Sugano does not disclose that the graphitization of carbon is accomplished by thermal plasma processing. The disclosure of Sugano suggests that the sulfur would be embedded into the

carbon material because the sulfur was mixed into the raw carbon material prior to the heat treatment. Therefore, Sugano describes a non-plasma heat treatment method that causes solid sulfur to be included throughout a carbon material. In view of this, one would not have been led to have included sulfur into the plasma processing of Kurihara, or to have located sulfur onto a surface of an electrode carbon material as required in claim 1.

The present application performs thermal plasma processing that introduces an elementary sulfur or a sulfur-containing functional compound including sulfur onto the surface of a carbon material. See para. [0013]. However, the elementary sulfur or the sulfur-containing functional group including sulfur is mixed in the thermal processing atmosphere, not into the carbon raw material. The introduction of the elementary sulfur or the sulfur-containing functional group including sulfur in a gaseous state could not be accomplished using the thermal processing of Sugano.

Therefore, it would not have been obvious to one of ordinary skill in the art to have introduced gaseous elementary sulfur or a sulfur-containing functional group including sulfur to a carbon material based on the thermal processing method of carbon material from the teachings of Sugano. The combination of Kurihara and Sugano would not have led one of ordinary skill in the art to the present claims because the sulfur would have been introduced as a solid and the heat treatment would not have introduced a gaseous elementary sulfur or sulfur-containing functional group including sulfur to the surface of the carbon material.

Additionally, one of ordinary skill in the art would have had no reason or rationale to have used thermal plasma processing to have introduced gaseous elementary sulfur or a sulfur-containing functional compound including sulfur onto the surface of a carbon material based on the disclosures or Kurihara and Sugano.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection.

B. Kurihara, Sugano And Takami

The Office Action rejects claim 5 under 35 U.S.C. § 103(a) as allegedly having been obvious over Kurihara in view of Sugano and further in view of Takami (U.S. Patent No. 5,340,670). Applicants respectfully traverse this rejection.

Takami does not remedy any of the deficiencies of Kurihara and Sugano. Takami discloses a carbon material for a lithium secondary battery that is capable of absorbing and desorbing lithium ions to suppress the reaction between lithium and the nonaqueous electrolyte. See col. 1, l. 61 to col. 2, l. 2. However, Takami does not describe a thermal plasma processing method that introduces gaseous elementary sulfur or sulfur-containing functional groups including sulfur onto an electrode carbon material surface. Instead, Takami describes a process of graphitizing a carbon material through a heat treatment. See col. 13, l. 33-37. Also, Takami states that no sulfur content or a low sulfur content is preferred. See col. 15, l. 49-57.

Thus, no combination of the cited references would have rendered obvious claim 1. Claim 5 depends on claim 1. For at least the dependency, and for the additional features recited, the combination of cited references also would not have rendered obvious claims 5.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection.

II. New Claim 16 Defines Patentable Subject Matter

Claim 16 is patentable at least for its dependency from independent claim 1 as well as for the additional features it recites. Specifically, Applicants assert that Kurihara, Sugano and Takami, either alone or in combination, do not disclose or suggest use of a sulfur-containing compound in a gas state, as recited in claim 16.

III. New Claim 17 Defines Patentable Subject Matter

Claim 17 is patentable at least for its dependency from independent claim 1 as well as for the additional features it recites. Specifically, Applicants assert that Kurihara, Sugano and Takami, either alone or in combination, do not disclose or suggest an electrode carbon material with sulfur hexafluoride on a surface, as recited in claim 17.

The thermal processing atmosphere method of the present application utilizes hydrogen and fluoride in the carbon material, which efficiently promotes the elementary sulfur or the sulfur-containing functional group including sulfur onto the carbon material surface. The use of hydrogen improves the initial charging and discharging efficiency. See para. [0042]. As for fluoride, there is a correlation between the amount of sulfur and the amount of fluorine in the carbon material. See Tanaka Article, pg. 3233-3234 and Fig. 10, attached. The utilization of hydrogen and fluoride in the thermal processing method of the present application allows the carbon bond to be cutoff, allowing introduction of the gaseous elementary sulfur or sulfur-containing functional group including sulfur onto the surface of the electrode carbon material.

II. Request For Rejoinder

Upon allowance of claims 1-8 and 16-17, Applicants respectfully request rejoinder of the presently withdrawn claims 9-15.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-17 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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Attachment:
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Date: June 3, 2010

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